Customer Benefits

- Enables use of TLPs to 3,000 m water depth
- Provides an alternative surface facility for TTRs in Ultra-Deep Waters
- Applicable for Large displacement TLPs in any water depth
- Increased structural redundancy compared to conventional tendons
- Less critical welding requirements means more options for fabrication
- Installation does not require high hook HLV

Introduction

Tension Leg Platforms (TLP) have been the favorable choice for deep-water field development, specifically where drilling, workover, SCRs, and/or dry-tree completion with top-tension risers are hosted on the FPU. Currently there are over a dozen TLPs installed in regions including the GOM, Southeast Asia, and West Africa. Furthermore, several TLPs are currently in various stages of design and fabrication, for installation in the GOM, West Africa and Brazil in the near future. For a TLP in ultra-deep water, the technical and commercial practicality is mainly determined and governed by those of the tendon system. The application of TLPs faces technical and economical limits for water depths beyond 1,500 meters, due to limitations of the conventional tendon system. Also, the cost of conventional tendon installation in certain regions is sometimes prohibitive for the commercial viability of the project.

The Cellular Tendon technology is an enabling technology for TLPs to meet the industry’s demands for producing oil and gas in ultra-deep waters to 3,000m. The cellular tendon technology shows clear advantage for ultra-deepwater FPUs for a large range of throughputs/payloads in ultra-deep water depths. This technology mainly relies on proven industry products for tendon components, and existing industry practices to construct and install the Cellular Tendons.
Advantages

- Utilizes qualified existing products and proven industry practices to provide sufficient vertical and lateral stiffness while maintaining efficient resistance to tension-collapse in the ultra-deep water
- Has high flexibility to accommodate wide range of topside payloads with displacements from 50,000 ton to 150,000 ton
- Higher level of structural redundancy in the tendon main body thanks to the multiple-string construction for both the towing / installation and in-place conditions
- Enhanced local fabricability. The design can accommodate less stringent S-N curves
- Material cost savings from small hull size, omitting mechanical couplings, and Installation cost savings from not needing heavy lift vessels

Limitations of Current Non-Ship Shaped Floaters

Cellular Tendon Configurations

Comparison of Conventional Tendons vs. Cellular Tendon

<table>
<thead>
<tr>
<th></th>
<th>Conventional Tendon</th>
<th>Cellular Tendon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>Single pipe main body with TTS and TSB</td>
<td>Multiple cell pipe main body with TTS and TSB</td>
</tr>
<tr>
<td>Connection</td>
<td>Coupling</td>
<td>Girth Weld</td>
</tr>
<tr>
<td>Construction</td>
<td>In segments 200–300 ft (60–90m)</td>
<td>String near total tendon length, assembled on-shore</td>
</tr>
<tr>
<td>Transportation</td>
<td>Transported in grapple to site</td>
<td>Towed to site</td>
</tr>
<tr>
<td>Installation</td>
<td>HLV lift and assemble piece by piece, stab-in and latch to foundation</td>
<td>Latched, pulled in and latch to foundation</td>
</tr>
<tr>
<td>Pre-service</td>
<td>Supported by TSB</td>
<td>Supported by TSB</td>
</tr>
<tr>
<td>Connect to TLP</td>
<td>Guided and latch into tendon porch, Deballasted TLP to apply tendon pretension</td>
<td>Guided and latch into tendon porch, Deballasted TLP to apply tendon pretension</td>
</tr>
</tbody>
</table>

Publications

Z. J. Yu

For more information, contact:
technology@intecsea.com
www.intecsea.com